REMARKS

Independent claims 16, 30, 31, 32, 33, and 34 have been amended to remove various limitations unnecessary for distinguishing over the applied prior art. Claim 35 has been amended to properly depend from 34.

Entry of the amendments in the present application is respectfully requested as placing this case in condition for allowance. Review and reconsideration on the merits are requested.

Claims 32-34 were rejected under 35 U.S.C. § 112, second paragraph. The Examiner considered these claims as not being distinct from one another in that the recitation of intended use (e.g., ...for determining the oxygen concentration of a gas; ... for determining the humidity of the gas; ... for determining the oxygen concentration as a component of the gas containing NOx) and the voltage range applied by the circuit for applying an electric potential do not impart structural distinction. Basically, the Examiner's position was that each of claims 32-34 define a sensor having the same structure.

Applicants respectfully traverse for the following reasons.

In response, claims 32-34 have been amended to employ means-plus-function terminology, to recite that the respective sensors comprise means for applying an electrical potential in the range 0.2 V to 1.1 V; means for applying an electrical potential in the range of 1.1 V to 2.5 V; and means for applying an electrical potential in the range of 0.2 V to less than 0.5 V. By employing means-plus-function terminology, the respective functions also define structure. Thus, for example, a "means for applying an electrical potential in the range of 0.2 V to 1.1 V" would not literally encompass a circuit for applying an electric potential of, e.g., 2V.

With this amendment, claims 32-34 are distinct from one another, and withdrawal of the foregoing rejection under 35 U.S.C. § 112 is respectfully requested.

Claims 30-35 were rejected under 35 U.S.C. § 102(a) as being anticipated by U.S. Patent 5,672,811 to Kato et al. Claim 31 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Kato et al. Claim 33 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Kato et al in view of U.S. Patent 5,384,630 to Yagi et al. Claims 16-20 and 22-24 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kato et al in view of JP '773 or U.S. Patent 4,657,659 to Mase et al. The grounds for rejection remain the same as set forth in the previous Office Action.

Applicants traverse, and respectfully request the Examiner to reconsider in view of the following remarks.

The basis for rejection is that Fig. 2 of Kato et al. is said to show electrode 28 having an area larger than twice the size of electrode 24. However, it is respectfully submitted that the Examiner is not entitled to make that presumption, and that such presumption is not supported by the specification of Kato '811.

Particularly, as described at column 9, lines 39-41, Fig. 2 of Kato '811 shows a cross section taken along line A-A of Fig. 1-which does not represent the relative electrode areas. Namely, the rejection is based on the presumption that the width of electrodes 28 and 24 is the same. However, that is not necessarily the case. Furthermore, there is nothing in the specification of Kato '811 which further describes these electrodes in a manner which would allow for determining their relative areas. Moreover, there is nothing in Kato '811 which

describes any advantage of making the area of electrode 28 at least twofold that of electrode 24, and Kato '811 is entirely silent with respect to the relationship between electrode area ratio and element resistance.

For example, Fig. 4 of U.S. Patent 5,403,452 to Hielscher et al. (of record) shows the situation where the cross sectional area at a single position (upper figure) provides no information regarding the electrode area (lower figure). That is, the vertical dimension of electrode 1 is much shorter than that of electrode 2, which information is not reflected in the upper cross section. A copy of the first two cover pages of U.S. Patent 5,403,452 is attached for the Examiner's convenience.

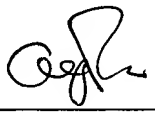
As discussed in MPEP § 2125, "the drawings must be evaluated for what they reasonably disclosed and suggest to one of ordinary skill in the art". Regarding Fig. 2 of Kato '811, the cross section taken along line A-A gives absolutely no information regarding the relative electrode areas.

For the above reasons, it is respectfully submitted that the rejected claims are pantentable over the prior prior art and withdrawal of the foregoing rejection is respectfully requested.

Withdrawal of all rejections and allowance of the claims 16-20, 22, 24, and 30-35 is earnestly solicited.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington D.C. telephone number indicated below.

Respectfully submitted,



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APPENDIX
VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

The claims are amended as follows:

16. (Three times amended) A sensor element comprising negative and positive electrodes disposed on the same side of a solid electrolyte substrate and a circuit for applying an electric potential between said negative electrode and said positive electrode, wherein

the area of said negative electrode and the area of said positive electrode differ by at least twofold [and said areas are set such that the element resistance measured between the negative and positive electrodes is minimized,

at least one of said negative electrode and said positive electrode is embedded in the solid electrolyte substrate; and

the area ratio of the negative and positive electrodes is such that the element resistance measured between the negative and positive electrodes is 94% or less than the element resistance of the same sensor except in which the negative electrode and the positive electrode have the same area].

30. (Three times amended) A sensor for detecting an amount of a gas, comprising

an oxygen-ion conductive solid electrolyte substrate having a flat side, a negative electrode and a positive electrode formed on the same flat side of the substrate so as to pump oxygen from the negative electrode to the positive electrode, and a gas diffusion limiting means for limiting the gas diffusing into the negative electrode,

wherein the ratio of the area of said negative electrode to the area of said positive electrode is set within a range of 2:1 to 5:1 [such that the element resistance measured between the negative and positive electrodes is minimized], and

said sensor comprising a circuit for applying an electric potential between said negative and positive electrodes such that a pump current [of less than 100 microamperes] flows between the negative and positive electrodes when the sensor is used for detecting the amount of a gas, said pump current being a measurement of the amount of gas.

31. (Three times amended) A sensor for detecting an amount of a gas, comprising

an oxygen-ion conductive solid electrolyte substrate having a flat side, a negative electrode and a positive electrode formed on the same flat side of the substrate so as to pump oxygen from the negative electrode to the positive electrode, and a gas diffusion limiting means for limiting the gas diffusing into the negative electrode,

wherein the ratio of the area of said negative electrode to the area of said positive electrode is set within a range of 1:2 to 1:5 [such that the element resistance measured between the negative and positive electrodes is minimized], and

said sensor comprising a circuit for applying an electric potential between said negative and positive electrodes such that a pump current [of less than 100 microamperes] flows between the negative and positive electrodes when the sensor is used to detect the amount of a gas, said pump current being a measurement of the amount of gas.

32. (Twice amended) An oxygen sensor for determining the oxygen concentration of a gas, comprising first and second chambers (62, 64) formed between first and second oxygen ion conductive cell substrates (66, 68) and first and second electrodes (68a, 68b) formed on the same plane of the second cell substrate (68), said first electrode (68a) being formed on an inside wall of the second chamber (64) and said second electrode (68b) being formed outside of the second chamber (64),

wherein the area of the first electrode is at least twofold larger than that of the second electrode [and said areas are set such that the element resistance measured between the negative and positive electrodes is minimized], and

the [second] sensor comprises [a circuit] means for applying an electric potential in the range of 0.2 V to 1.1 V between the first and second electrodes such that a pump current [of less than 100 microamperes] flows between the first and second electrodes when the sensor is used to determine the concentration of oxygen in a gas, said pump current being a measurement of oxygen concentration.

33. (Twice amended) A humidity sensor for determining the humidity of a gas, comprising first and second chambers (62, 64) formed between first and second oxygen ion conductive cell substrates (66, 68) and first and second electrodes (68a, 68b) formed on the same plane of the second cell substrate (68), said first electrode (68a) being formed on an inside wall of the second chamber (64) and said second electrode (68b) being formed outside of the second chamber (64),

wherein the area of the first electrode is at least twofold larger than that of the second electrode [and said areas are set such that the element resistance measured between the negative and positive electrodes is minimized], and

the sensor comprises [a circuit] means for applying an electric potential in the range of 1.1 V to 2.5 V between the second electrodes such that a pump current [of less than 10 microamperes] flows between the first and second electrodes when the sensor is used to determine the humidity of a gas, said pump current being a measurement of humidity.

34. (Twice amended) An oxygen sensor for determining the oxygen concentration as a component of a gas containing NOx, comprising first and second chambers (62, 64) formed between first and second oxygen ion cell substrates (66, 68) and first and second electrodes (68a, 68b) formed on the same plane of the second cell substrate (68), said first electrode (68a) being formed on an inside wall of the second chamber (64) and said second electrode (68b) being outside of the second chamber (64),

wherein the area of the first electrode is at least twofold larger than that of the second electrode [and said areas are set such that the element resistance measured between the negative and positive electrodes is minimized], and

the sensor comprises [a circuit] means for applying an electric potential in the range of 0.2 V to less than 0.5 V such that a pump current [of less than 100 microamperes] flows between the first and second electrodes when the sensor is used to determine oxygen concentration as a component of a gas containing NOx, said pump current being a measurement of oxygen concentration.

35. (Amended) The oxygen sensor as claimed in [claim 35], claim 34 comprising a circuit for applying an electric potential in the range of 0.2 V to less than 0.5 V such that a pump current of less than 10 microamperes flows between the first and second electrodes when the sensor is used to determine oxygen concentration as a component of a gas containing NOx, said pump current being a measurement of oxygen concentration.